Amendment to the Specification

On page 23, line 2, delete the word "with" and replace with "for" by replacing the first paragraph on p. 23 with the following:

Figures 13a through 13c show front and side view respectively of how one, two and three sensor systems may be used for detecting imminent propeller contact for an outboard electric motor.

(Provided as Appendix A)

On page 98, last word in line 4, replace "design" with "designed" by replacing the first paragraph on this page with the following:

One way to decrease drag using a trolling motor is to incorporate the motor in a Maruta (TM) design for higher speed electric watercraft. While adapting trolling motors for use in prototype Maruta hulls the inventor discovered that the axle of such motor generally is the first part to receive waste heat, despite the fact that the motor is designed to transfer heat through the metallic casing to the surrounding water. That is, heat more readily transfers to the axle, not the casing in many situations, yet the casing is used to transfer the waste heat. In studying this problem, several new conformations of motor design and axle design were discovered that utilize the axle more fully to dissipate heat, allowing greater design flexibility for the motor case and in some cases allowing design of the motor casing into the boat surface. In an embodiment the motor case is modified to allow greater hydrodynamic matching with hull design while allowing good water contact to dissipate the heat. In a related embodiment, batteries that can be charged rapidly but which generate much waste heat are mounted in the hull to allow good thermal contact with the water.

(Provided as Appendix B)

Amendment to the Claims (Unmarked copy of claims provided as Appendix C)

Amend the claims as follows:

1. (Original) An overspeed mechanism for exceeding the continuous duty power output of an electric motor in a vehicle, comprising: a) an electric motor with a given continuous duty power rating; b) a power supply for the motor comprising an energy source and power control circuitry for providing electric energy to the motor in excess of the continuous power rating; c) a switch for activating overspeed power to the motor; and d) a temperature detector with associated control circuitry located on at least the motor or power supply component, wherein the switch engages the power supply to supply power in excess of the continuous power rating, the temperature detector continuously monitors temperature and the temperature detector associated control circuitry blocks the provision of power to the motor in excess of the motor's continuous duty power rating upon detection of a high temperature by the temperature detector.

2. (Original) An overspeed mechanism as described in claim 1, wherein the electric motor has a continuous power rating of between 3 and 30 horsepower.

3. (Cancelled).

4. (Cancelled) An overspeed mechanism as described in claim 1, wherein the power control circuitry comprises capacitive banks that periodically become charged and discharged into the motor, wherein the discharge voltage applied to the motor exceeds the battery voltage.

5. (Original) An overspeed mechanism as described in claim 1, further comprising a visual indicator of the status of overspeed capability.

6. (Original) An overspeed mechanism as described in claim 5, wherein the visual indicator is selected from the group consisting of a green light indicating that overspeed power is available, a yellow light indicating that some but not maximum overspeed power is available, a red light indicating that no overspeed power is available, a gauge

with a needle that displays the relative amount of overspeed time available, and a digital readout that indicates relative or absolute amount of overspeed time available.

7. (Herein amended) An overspeed mechanism as described in claim 1, further comprising at least one of a water pump for for transporting water into contact with a surface of the motor upon activation of the overspeed mechanism and an electric fan for cooling the electric motor, thereby the fan is activated upon activation of the overspeed mechanism.

8. (Cancelled)

9. (Herein amended) A watercraft or land vehicle that comprises an overspeed mechanism as described in claim 1.

10. (Cancelled)

11. (Original) A kit for adding overspeed capability to a vehicle, comprising an overspeed mechanism as described in claim 1, and one or more fasteners for attaching one or more components of the overspeed mechanism to the vehicle.

12. (Original) An electric vehicle power supply usage efficiency monitor, comprising:

a) an electrical signal receiving input that accepts a signal which indicates the relative or absolute state of power supply depletion;

b) at least one circuit or software program implemented in a microprocessor or other hardware that compares the input from a) with a factor that accounts for the cost of the power supply and that outputs a signal corresponding to both rate of power usage and state of power supply depletion; and

c) a signaling device that indicates cost or efficiency of power use to an operator of the vehicle.

13. (Original) A monitor as described in claim 12, wherein the power supply is selected from the group consisting of an electric storage battery, a lead acid battery, a metal hydride battery, a nickel cadmium battery, a lithium battery, a hydrogen tank, a graphite hydrogen storage container, a carbon nanotube hydrogen storage container, a metal hydrogen storage container, an alcohol fuel storage container, a wet chemistry

reduced compound in a container, sodium borohydride in a container, and a hydrocarbon storage container.

14. (Original) A monitor as described in claim 12, wherein the power supply is a chemical that is used to supply energy for a fuel cell.

15. (Original) A monitor as described in claim 12, wherein the microprocessor of b) comprises a look up table of values or an algorithm corresponding to a power supply life use time at the measured power supply depletion.

16. (Original) A monitor as described in claim 12, wherein the signaling device is selected from the group consisting of a visual analog meter, a visual bar meter, a visual meter with regions showing relative or absolute projected energy costs, a digital meter, a digital meter showing relative or absolute projected energy costs, and an auditory device.

17 (Original) A monitor as described in claim 12, wherein the microprocessor of b) comprises a look up table of values or algorithm corresponding to added energy costs for reversibly depositing a chemical fuel for powering a fuel cell in the storage container.

18. (Original) A monitor as described in claim 12, wherein the vehicle is a watercraft.

19. (Original) A monitor as described in claim 18, further comprising a control governor circuit that automatically decreases electrical power use to a lower maximum value that conserves the health of the power supply.

20. (Cancelled)

21. (Cancelled)

22. (Cancelled)

23. (Cancelled)

24. (Original) A battery health monitor for a vehicle, comprising:

a) a hardware circuit comprising i) signal inputs for a power demand signal and for a state of capacity signal, ii) at least a microprocessor or other circuitry for comparing the signal input with one or more stored values, iii) a temperature transducer that monitors the battery temperature, iv) a reference signal value corresponding to the status of a healthy battery, and v) an electrical output from the hardware circuit to indicate battery health; and

b) a signaling device that receives the electrical output from the hardware circuit to indicate battery health to an operator of the vehicle;

wherein the hardware circuit tests the battery's ability to generate power by 1) asserting a known load on the battery, 2) measuring the battery output in response to the known load to generate a power demand signal, 3) compensating the power demand signal for power with a temperature signal from the temperature transducer, and 4) compensating the power demand signal with a state of capacity signal indicating the state of battery depletion, and 5) comparing the double compensated signal with a reference signal to generate the output signal indicating battery health.

25. (Original) A battery health monitor as described in claim 24, wherein the signaling device is a panel mounted device selected from the group consisting of an analog meter with colored regions, an analog meter with green yellow and red areas to indicate multiple full battery charge cycles remaining, few full battery charge cycles remaining and no full battery charge cycles remaining respectiv, an analog meter with numeric display of relative or absolute number of battery charge cycles remaining, a light to alert when few or no full battery recharge cycles remain, a buzzer to alert when few or no full battery recharge cycles remain, an alert light within a fuel panel gauge to alert when few

or no full battery recharge cycles remain, and a panel display.

26. (Original) A battery health monitor as described in claim 24, wherein the hardware circuit test of the battery with the known load occurs automatically during a recharge cycle and the result is used to update the output signal.

27. (Original) A battery health monitor as described in claim 26, wherein the test occurs at a point determined by a reference voltage and wherein the charging battery voltage exceeds the reference voltage.

28. (Original) A battery health monitor as described in claim 24, further comprising a push button switch that asserts the known load on the battery to allow user interrogation of a present battery health status.

29. (Original) A battery health monitor as described in claim 24, wherein the reference signal is obtained by asserting the known load on the battery when the battery is first used.

30. (Original) A battery health monitor as described in claim 24, wherein the temperature transducer is a thermister that is mechanically and thermally coupled to a battery terminal.

31. (Currently Amended) A fuel cell health monitor for a vehicle, comprising:

a) a hardware circuit comprising i) signal input for a power demand signal ii) at least a microprocessor or other circuitry for comparing the signal input with one or more stored values, iii) a reference signal ~~value~~ corresponding to the status of a healthy fuel cell, and iv) an electrical output from the hardware circuit to indicate ~~battery~~ fuel cell health; and

b) a signaling device that receives the electrical output from the hardware circuit to indicate fuel cell health to an operator of the vehicle;

wherein the hardware circuit tests or monitors a fuel cell param ter associated with the

fuel cell's ability to generate power by 1) asserting or detecting a known load on the fuel cell, 2) measuring the fuel cell output in response to the known load ~~to generate a power demand signal~~ and, 3) comparing the measured output ~~in response~~ with the ~~a~~ reference signal to generate the output signal indicating fuel cell health.

32. (Original) A fuel cell health monitor as described in claim 31, wherein the load is a resistive load and the measured fuel cell output is a current at a known voltage to derive an impedance that is compared with the reference signal.

33. (Original) A fuel cell health monitor as described in claim 31, further comprising a fuel cell temperature measurement, wherein the measured fuel cell output in response to the known load is calibrated by the temperature measurement before comparing with a reference signal.

34. (Original) A fuel cell health monitor as described in claim 31, wherein the measured fuel cell output response is an impedance of a membrane within the fuel cell.

35. (Original) A fuel cell health monitor as described in claim 31, wherein the signaling device is a panel mounted device selected from the group consisting of an alert light to indicate that a membrane or other degradable part of a fuel cell requires replacing, an alert light within a fuel gauge to indicate that a membrane or other degradable part of a fuel cell requires replacing, an analog meter with green yellow and red areas to indicate that a fuel cell membrane or other degradable part of the fuel cell has good marginal or no life remaining respectively, an analog meter with numeric display of time or energy flow remaining before a fuel cell membrane or other degradable part of the fuel cell should be replaced, time or total energy available from the fuel cell before fuel cell maintenance is required; a light to alert when fuel cell maintenance is required; a buzzer to alert when fuel cell maintenance is required, and a panel display.

36. (New) An electric vehicle power supply usage efficiency monitor as described in claim 12, wherein the signaling device indicates cost per unit distance or per unit time.

37. (New) A method for detecting the status of a fuel cell, comprising, obtaining a first stored reference value associated with performance of the fuel cell in good working order, obtaining a second measured value associated with performance of the fuel cell after or during use, comparing the first and second values, and outputting a result of the comparison in relative units or qualitatively to a signaling device that indicates the quality of the fuel cell.

38. (New) A method as described in claim 37, wherein the first and second values are internal impedance values across a catalyst or membrane used in the fuel cell.

39. (New) A method as described in claim 37, wherein the signaling device is selected from the group consisting of: a light, a symbol on a liquid crystal display, a buzzer, and a visual indicator of progressive loss in performance via one or more light emitting diodes that turn on in response to exceeding a threshold of performance loss.

40. (New) A method for detecting the filled status of a hydrogen binding fuel reservoir, comprising, obtaining a first stored reference value associated with performance of the reservoir in good working order, obtaining a second measured value associated with performance of the reservoir after or during use, comparing the first and second values, and outputting a result of the comparison in relative units or qualitatively to a signaling device that indicates the quality of the reservoir.

41. (New) A method as described in claim 40, wherein the first and second values are obtained by at least one of: measuring heat of release or binding of hydrogen to absorbent; measuring sound wave transmission in the reservoir; measuring an optical change of a hydrogen binding absorbent in the reservoir; and measuring electrical conductivity of a hydrogen binding absorbent in the reservoir.

42. (New) A method as described in claim 40, wherein temperature measurements are carried out within the reservoir while charging the reservoir with hydrogen.

Remarks

Claims 1-35 were pending prior to this amendment. This amendment cancels claims 3, 5, 10, 20, 21, 22, and 23; amends claims 7 and 9 and presents new claims 36-42. One word amendments to the specification on pages 23 and 98 correct typos. The original meanings of the two typos at these positions are appreciated by a skilled artisan, and no new matter has been added.

The contents of claim 36, are supported, for example on page 105 lines 13-14; claims 37-39 are supported for example on page 105 lines 23-30, page 109 line 29 through page 111 line 5, page 117 line 19 through 31; and claims 40-42 are supported, for example on page 116 line 1 through page 117 line 17.

Applicant suggests reviewing page 34 through the top of page 39 for the disclosure of claims 1-11 and reviewing page 103 line 14 through page 112 line 2 for the disclosure of claims 12-42.

Consideration and allowance are requested.

Respectfully submitted,

Marvin Motsenbocker

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(Appendix A)

Figures 13a through 13c show front and side view respectively of how one, two and three sensor systems may be used for detecting imminent propeller contact with an outboard electric motor.

Figure 14a shows a bottom hull view of a two sensor system on a boat hull for detecting imminent propeller contact.

Figure 14b shows a rear hull view of a three sensor system on a boat hull for detecting imminent propeller contact.

Figure 15 shows a representative tactile sensor placement in accordance with an embodiment of the invention.

Figure 16 depicts a life cycle vs depth of discharge for a battery.

Figure 17a shows an analog meter that displays battery health. A red or orange color is positioned on the left end, green on the right end, and yellow in between.

Figure 17b shows an analog meter that displays battery health. The left side has a mark ("0" shown here) indicating that insufficient or low charge cycles remain. The right side has a mark ("200" shown here) indicating that high number of charge cycles remain available for the battery.

Figure 17c shows an analog meter that displays state of charge, having an indicator light that activates when battery impedance has risen to indicate battery replacement is needed.

Figure 17d shows an analog meter that displays state of charge, and also displaying battery health with a horizontal bar.

(Appendix B)

One way to decrease drag using a trolling motor is to incorporate the motor in a Maruta (TM) design for higher speed electric watercraft. While adapting trolling motors for use in prototype Maruta hulls the inventor discovered that the axle of such motor generally is the first part to receive waste heat, despite the fact that the motor is designed to transfer heat through the metallic casing to the surrounding water. That is, heat more readily transfers to the axle, not the casing in many situations, yet the casing is used to transfer the waste heat. In studying this problem, several new conformations of motor design and axle design were discovered that utilize the axle more fully to dissipate heat, allowing greater design flexibility for the motor case and in some cases allowing design of the motor casing into the boat surface. In an embodiment the motor case is modified to allow greater hydrodynamic matching with hull design while allowing good water contact to dissipate the heat. In a related embodiment, batteries that can be charged rapidly but which generate much waste heat are mounted in the hull to allow good thermal contact with the water.

In an embodiment, an electric motor axle is made long enough to provide a large contact surface with a conductive propeller. In common designs used most often for small electric motors such as those sold by Minn Kota and Motorguide (2 hp, 1 hp, 0.5 hp or less) the motor axle extends out of the case through a seal and a simple connection with a threaded portion of the axle is made to a non-thermal conductive propeller. In a particularly advantageous embodiment , in contrast, the motor axle extends further along the length (fore/aft) of the propeller and contacts the propeller through a larger distance. The axle extends and (more importantly contacts) at least 1/4 inch, preferably at least 0.4 inch, 0.5 inch, 0.75 inch, more preferably at least 1.0 inch, 1.25 inch, 1.50 inch or even greater than 2.0 inches of a propeller hub wherein the propeller is made from a thermoconductive material. The propeller thermoconductive material may for example, be metal such as aluminum or brass, plastic or other thermally conductive polymer, or a ceramic material and has an opening in the center that thermally contacts the motor axle. Preferably the thermal contact occurs through a bore in the propeller that preferably is at least 0.5 inch, 0.75 inch, more preferably at

CLEAN COPY OF AMENDED CLAIMS

1. An overspeed mechanism for exceeding the continuous duty power output of an electric motor in a vehicle, comprising: a) an electric motor with a given continuous duty power rating; b) a power supply for the motor comprising an energy source and power control circuitry for providing electric energy to the motor in excess of the continuous power rating; c) a switch for activating overspeed power to the motor; and d) a temperature detector with associated control circuitry located on at least the motor or power supply component, wherein the switch engages the power supply to supply power in excess of the continuous power rating, the temperature detector continuously monitors temperature and the temperature detector associated control circuitry blocks the provision of power to the motor in excess of the motor's continuous duty power rating upon detection of a high temperature by the temperature detector.

2. An overspeed mechanism as described in claim 1, wherein the electric motor has a continuous power rating of between 3 and 30 horsepower.

4. An overspeed mechanism as described in claim 1, wherein the power control circuitry comprises capacitive banks that periodically become charged and discharged into the motor, wherein the discharge voltage applied to the motor exceeds the battery voltage.

5. An overspeed mechanism as described in claim 1, further comprising a visual indicator of the status of overspeed capability.

6. An overspeed mechanism as described in claim 5, wherein the visual indicator is selected from the group consisting of a green light indicating that overspeed power is available, a yellow light indicating that some but not maximum overspeed power is available, a red light indicating that no overspeed power is available, a gauge with a needle that displays the relative amount of overspeed time available, and a digital readout that indicates relative or absolute amount of overspeed time available.

7. An overspeed mechanism as described in claim 1, further comprising at least one of a water pump for for transporting water into contact with a surface of the motor upon activation of the overspeed mechanism and an electric fan for cooling the electric motor, thereby the fan is activated upon activation of the overspeed mechanism.

9. A watercraft or land vehicle that comprises an overspeed mechanism as described in claim 1.

11. A kit for adding overspeed capability to a vehicle, comprising an overspeed mechanism as described in claim 1, and one or more fasteners for attaching one or more components of the overspeed mechanism to the vehicle.

12. An electric vehicle power supply usage efficiency monitor, comprising:

a) an electrical signal receiving input that accepts a signal which indicates the relative or absolute state of power supply depletion;

b) at least one circuit or software program implemented in a microprocessor or other hardware that compares the input from a) with a factor that accounts for the cost of the power supply and that outputs a signal corresponding to both rate of power usage and state of power supply depletion; and

c) a signaling device that indicates cost or efficiency of power use to an operator of the vehicle.

13. A monitor as described in claim 12, wherein the power supply is selected from the group consisting of an electric storage battery, a lead acid battery, a metal hydride battery, a nickel cadmium battery, a lithium battery, a hydrogen tank, a graphite hydrogen storage container, a carbon nanotube hydrogen storage container, a metal hydrogen storage container, an alcohol fuel storage container, a wet chemistry reduced compound in a container, sodium borohydride in a container, and a hydrocarbon storage container.

14. A monitor as described in claim 12, wherein the power supply is a chemical that is used to supply energy for a fuel cell.

15. A monitor as described in claim 12, wherein the microprocessor of b) comprises a look up table of values or an algorithm corresponding to a power supply lif use time

at the measured power supply depletion.

16. A monitor as described in claim 12, wherein the signaling device is selected from the group consisting of a visual analog meter, a visual bar meter, a visual meter with regions showing relative or absolute projected energy costs, a digital meter, a digital meter showing relative or absolute projected energy costs, and an auditory device.

17 A monitor as described in claim 12, wherein the microprocessor of b) comprises a look up table of values or algorithm corresponding to added energy costs for reversibly depositing a chemical fuel for powering a fuel cell in the storage container.

18. A monitor as described in claim 12, wherein the vehicle is a watercraft.

19. A monitor as described in claim 18, further comprising a control governor circuit that automatically decreases electrical power use to a lower maximum value that conserves the health of the power supply.

24. A battery health monitor for a vehicle, comprising:

a) a hardware circuit comprising i) signal inputs for a power demand signal and for a state of capacity signal, ii) at least a microprocessor or other circuitry for comparing the signal input with one or more stored values, iii) a temperature transducer that monitors the battery temperature, iv) a reference signal value corresponding to the status of a healthy battery, and v) an electrical output from the hardware circuit to indicate battery health; and

b) a signaling device that receives the electrical output from the hardware circuit to indicate battery health to an operator of the vehicle;

wherein the hardware circuit tests the battery's ability to generate power by 1) asserting a known load on the battery, 2) measuring the battery output in response to the known load to generate a power demand signal, 3) compensating the power demand signal for power with a temperature signal from the temperature transducer, and 4) compensating

the power demand signal with a state of capacity signal indicating th state of battery depletion, and 5) comparing the double compensated signal with a reference signal to generate the output signal indicating battery health.

25. A battery health monitor as described in claim 24, wherein the signaling device is a panel mounted device selected from the group consisting of an analog meter with colored regions, an analog meter with green yellow and red areas to indicate multiple full battery charge cycles remaining, few full battery charge cycles remaining and no full battery charge cycles remaining respectiv, an analog meter with numeric display of relative or absolute number of battery charge cycles remaining, a light to alert when few or no full battery recharge cycles remain, a buzzer to alert when few or no full battery recharge cycles remain, an alert light within a fuel panel gauge to alert when few or no full battery recharge cycles remain, and a panel display.

26. A battery health monitor as described in claim 24, wherein the hardware circuit test of the battery with the known load occurs automatically during a recharge cycle and the result is used to update the output signal.

27. A battery health monitor as described in claim 26, wherein the test occurs at a point determined by a reference voltage and wherein the charging battery voltage exceeds the reference voltage.

28. A battery health monitor as described in claim 24, further comprising a push button switch that asserts the known load on the battery to allow user interrogation of a present battery health status.

29. A battery health monitor as described in claim 24, wherein the reference signal is obtained by asserting the known load on the battery when the battery is first used.

30. A battery health monitor as described in claim 24, wherein the temperature transducer is a thermister that is mechanically and th rmally coupled to a battery

terminal.

31. A fuel cell health monitor for a vehicle, comprising:

a) a hardware circuit comprising i) signal input for a power demand signal ii) at least a microprocessor or other circuitry for comparing the signal input with one or more stored values, iii) a reference corresponding to the status of a healthy fuel cell, and iiv) an electrical output from the hardware circuit to indicate fuel cell health; and

b) a signaling device that receives the electrical output from the hardware circuit to indicate fuel cell health to an operator of the vehicle;

wherein the hardware circuit tests or monitors a fuel cell parameter associated with the fuel cell's ability to generate power by 1) asserting or detecting a known load on the fuel cell, 2) measuring the fuel cell output in response to the known load and, 3) comparing the measured output with the reference signal to generate the output signal indicating fuel cell health.

32. A fuel cell health monitor as described in claim 31, wherein the load is a resistive load and the measured fuel cell output is a current at a known voltage to derive an impedance that is compared with the reference signal.

33. A fuel cell health monitor as described in claim 31, further comprising a fuel cell temperature measurement, wherein the measured fuel cell output in response to the known load is calibrated by the temperature measurement before comparing with a reference signal.

34. A fuel cell health monitor as described in claim 31, wherein the measured fuel cell output response is an impedance of a membrane within the fuel cell.

35. A fuel cell health monitor as described in claim 31, wherein the signaling device is a panel mounted device selected from the group consisting of an alert light to indicate that a membrane or other degradable part of a fuel cell requires replacing, an alert light

within a fuel gauge to indicate that a membrane or other degradable part of a fuel cell requires replacing, an analog meter with green yellow and red areas to indicate that a fuel cell membrane or other degradable part of the fuel cell has good marginal or no life remaining respectively, an analog meter with numeric display of time or energy flow remaining before a fuel cell membrane or other degradable part of the fuel cell should be replaced, time or total energy available from the fuel cell before fuel cell maintenance is required; a light to alert when fuel cell maintenance is required; a buzzer to alert when fuel cell maintenance is required, and a panel display.

36. An electric vehicle power supply usage efficiency monitor as described in claim 12, wherein the signaling device indicates cost per unit distance or per unit time.

37. A method for detecting the status of a fuel cell, comprising, obtaining a first stored reference value associated with performance of the fuel cell in good working order, obtaining a second measured value associated with performance of the fuel cell after or during use, comparing the first and second values, and outputting a result of the comparison in relative units or qualitatively to a signaling device that indicates the quality of the fuel cell.

38. A method as described in claim 37, wherein the first and second values are internal impedance values across a catalyst or membrane used in the fuel cell.

39. A method as described in claim 37, wherein the signaling device is selected from the group consisting of: a light, a symbol on a liquid crystal display, a buzzer, and a visual indicator of progressive loss in performance via one or more light emitting diodes that turn on in response to exceeding a threshold of performance loss.

40. A method for detecting the filled status of a hydrogen binding fuel reservoir, comprising, obtaining a first stored reference value associated with performance of the reservoir in good working order, obtaining a second measured value associated with performance of the reservoir after or during use, comparing the first and second values,

and outputting a result of the comparison in relative units or qualitatively to a signaling device that indicates the quality of the reservoir.

41. A method as described in claim 40, wherein the first and second values are obtained by at least one of: measuring heat of release or binding of hydrogen to absorbent; measuring sound wave transmission in the reservoir; measuring an optical change of a hydrogen binding absorbent in the reservoir; and measuring electrical conductivity of a hydrogen binding absorbent in the reservoir.

42. A method as described in claim 40, wherein temperature measurements are carried out within the reservoir while charging the reservoir with hydrogen.